REMARKS

I. Introduction

By the present Amendment, claims 1-3, 5-7, 11, 13, 18, 20, and 21 have been amended. No claims have been added or cancelled. Accordingly, claims 1-21 remain pending in the application. Claims 1-3, 5-7, 11, 13, 18, 20, and 21 are independent.

II. Office Action Summary

In the Office Action of July 17, 2007, claims 1-12, 20, and 21 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 6,980,846 issued to Hardy et al. in view of U.S. Patent No. 5,479,537 issued to Hamashima. Claims 13-19 were rejected under 35 USC §103(a) as being unpatentable over Hardy in view of Hamashima, and further in view of U.S. Patent No.5,668,474 issued to Heid. These rejections are respectfully traversed.

III. Rejections under 35 USC §103

Claims 1-12, 20, and 21 were rejected under 35 USC §103(a) as being unpatentable over Hardy in view of Hamashima. Regarding this rejection, the Office Action alleges that Hardy discloses a method for acquiring image data from a subject with an MRI system, and that the general the components of an MRI system are well known in the art. The Office Action specifically asserts that Hardy discloses an MRI system that acquires a reference data set of a region of interest, such as the motion of the heart or the heartbeat, and then acquires a plurality of free-breathing data sets of the same region of interest. The free-breathing data sets are subsequently compared with the reference data for use in creating an image of the region of

interest. The Office Action indicates that Hardy does not expressly disclose setting a threshold in order to determine which images to reject but notes that such a threshold could easily be set. Furthermore, the Office Action admits that Hardy does not perform a comparison using a similarity coefficient. Hamashima is relied upon for disclosing an image comparison method which uses cross correlation and threshold cutoff values to determine if an image matches a reference image. Hamashima is also indicated as disclosing a directionality free, or scalar, coefficient may be used.

By the present Amendment, Applicants have further revised the language of independent claim 1 to better define the invention in view of the art of record. The claimed inspection apparatus includes a controller that controls a pulse sequence that applies a radiofrequency magnetic field and a magnetic field gradient to a living body that has been placed in a static magnetic field in order to determine a nuclear magnetic resonance signal produced from the body. In order to achieve this result, the controller performs the following functions. First, in a state where the body is not exhaling or inhaling, the controller controls a first pulse sequence to detect the nuclear magnetic resonance signal and acquire a reference projection of an imaging section for monitoring the respiratory motion of the body. Next, during breathing, the controller controls execution of one of the first pulse sequence to detect the nuclear magnetic resonance signal and acquire a projection of the imaging section to monitor the state of the body during breathing. The controller further repeats a second pulse sequence to detect the nuclear magnetic resonance signal to acquire an image of the imaging section at predetermined repetition time intervals. Finally, the controller collects the nuclear magnetic resonance signals to reconstruct an image of the imaging section in the second pulse sequence based on a similarity coefficient

between the projection and the reference projection. According to independent claim 1, the similarity coefficient is in the form of a scalar value. Furthermore, the projection and reference projection are one-dimensional in nature.

As discussed in the Specification, when the reference projection is x_i, and the acquired projection is y_i, then the linear correlation coefficient r_1 can be calculated using formula (1). See page 25, line 11 to page 26, line 3. Accordingly, the similarity coefficient is obtained from one-dimensional projections corresponding to the projection and the reference projection. Such one-dimensional projections can be obtained, for example, from one-dimensional Fourier transform of the signals. Accordingly, it is possible to control the process in a shortened period of time. Furthermore, the nuclear resonance signals used for image reconstruction are accurately collected because the projection and reference projection accurately reflect information corresponding to the imaging section.

The Office Action alleges that Hardy discloses most of the features of the claimed invention. This does not appear to be the case. The system of Hardy uses multi-shot-spiral trajectories. See, e.g., Fig. 2. The comparison between the reference and the free breathing interleaves is accomplished through the use of the two-dimensional cross correlation. See col. 5, lines 11-13. Since a two-dimensional cross-correlation is being performed, a two-dimensional MR image is necessarily compared.

When comparing a two-dimensional MR image, the trajectory data is sampled in k-space, interpolated into a rectilinear grid, and transformed by Fourier transform to generate the MR image data samples. See col. 2, lines 58-61. Since data must be interpolated into a rectilinear grid the computation load and time are high, thereby increasing the length of the process.

The Office Action further alleges that Hardy discloses an MRI system that acquires a reference data set of a region of interest at col. 1, lines 27-33. Applicants respectfully disagree. The cited passage relates to the navigator-echo-gating technique and differs from a region of interest. The one-dimensional Fourier transform discussed is used to yield the position of the diaphragm as a function of time. This is then used either to trigger the acquisition of new coronary imaging data with slice and/or phase shifts which track the motion of the heart. See col. 1, lines 27-33. Hardy fails to provide any disclosure or suggestion for features of the claimed invention such as the projection and reference projection being one-dimensional in nature.

Hamashima discloses an image processing method and apparatus wherein an image obtained and a reference image are passed through differential filters. col. 11, lines 17-23. As shown in Fig. 8, the filter is two-dimensional. Consequently, the filtered image is necessarily two-dimensional. In fact, differential value shown in Eq. (13), etc., is calculated with respect to two subscript characters (i, j), clearly indicating that two dimensions are being considered. Thus, Hamashima also fails to provide any disclosure or suggestion for one-dimensional projections and reference projections.

Since both references fail to provide any disclosure or suggestion for the same features recited in independent claim 1, they necessarily fail to disclose or suggest all the claimed features when combined with each other. More particularly, the combination of references fails to provide any disclosure or suggestion for features recited in independent claim 1, including at least "said similarity coefficient being scalar" and "wherein said projection is one-dimensional, and said reference projection is one-dimensional."

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

The remaining independent claims (2, 3, 5-7, 11, 13, 18, 20, and 21) have all been amended to recite the feature of "wherein said projection is one-dimensional, and said reference projection is one-dimensional." Accordingly, these claims are also believed to be allowable over the art of record.

The dependent claims are also believed to be allowable for at least the reasons set forth with respect to the independent claims.

IV. Information Disclosure Statement

Concurrently submitted with this Amendment is an information disclosure statement listing various references. The claimed invention is believed to be allowable over these references for the following reasons. Both of references fail to disclose comparison of a one-dimensional projection of the projection and the reference projection. Rather, the references disclose comparison of a two-dimensional image.

(1) WO 01/84173 ("WO '173")

WO '173 discloses motion that is detected by comparing the current spherical navigator (SNAV) dataset to its predecessor in time. Rotations of the patient's head are encoded in the magnitude of the SNAV signal and translations are encoded in the phase of the signal. See paragraph [0022]. WO '173 compares the magnitude and the phase between a given SNAV dataset (e.g. $SNAV_n$) and its reference (e.g. $SNAV_0$) for detecting the motion of the patient. See paragraphs [0022] and [0026]. The magnitude and phase correspond to each point of the $SNAV_n$ surface. See paragraph [0026]. The degree of mismatch between the reference spherical

navigator (SNAV0) data set and the acquired (SNAVn) data set is also measured using the sum squared difference as the cost function, etc., for prospective or retroprospective correction of the fMRI image frame. See paragraph [0044). There is no disclosure or suggestion for features recited in the claimed invention such as "said similarity coefficient being scalar" and "wherein said projection is one-dimensional, and said reference projection is one-dimensional."

(2) U.S. Patent No. 5,977,769 to Bornert et al ("Bornert") (equivalent to EP 0793113A1)

Bornert discloses a sequence that includes a two-dimensional RF pulse which excites the nuclear magnetization along a line in temporal cooperation with two oscillating magnetic gradient fields. See col. 5, lines 13-17. The line is chosen so that it intersects, for example, the diaphragm as perpendicular as possible to detect the movement w of the diaphragm. See col. 5, lines 17-29. Along the line, the reference position w_0 is fixed and the displacement v, the difference between the reference position w_0 and the actual position w, is calculated. See col. 7, lines 19-21. Here, v is simply the difference between the position w_0 and w. Bornert also fails to disclose or suggest features recited in the claimed invention, such as "said similarity coefficient being scalar" and "wherein said projection is one-dimensional, and said reference projection is one-dimensional."

V. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

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AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.42912X00).

Respectfully submitted,
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